

Description

[SCANNING DEVICE AND METHOD USING PAIRED DIFFERENTIAL ANALOG SIGNALS]

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the priority benefit of Taiwan application serial no.91122106, filed on September 26, 2002.

BACKGROUND OF INVENTION

[0002] Field of Invention

[0003] The invention pertains to the field of signal transmission. More particularly, the invention pertains to transmissions between components of a scanning device and a method using paired differential analog signals for the same.

[0004] Description of Related Art: The scanner is a device having functions disposed between copy machines and cameras. Scanners used to be expensive, and were almost exclusively used by specialists. Recently, due to the advancement in technology, coupled with market competition, the

price of scanners has dropped. In fact, scanners have moved into the mainstream of personal computer peripherals.

[0005] Scanners can be divided into various categories either according to their sale price or function. Ordinarily, the scanner categories include handheld scanners, paper feeding scanners, card scanners, negative scanners, and the flat panel scanners, etc. Out of the above categories, the flat panel scanner is the most popular. The flat panel scanner is analogous to a flat glass panel. Texts or graphics are placed on top of the flat glass panel, the content of which is read by sensor. Because of simplicity of structure and ease of usage, coupled with the fact that it is highly expandable, flat panel scanners have moved into the mainstream of personal computer industry.

[0006] Currently, because the computer interface possesses an ever-increasing speed, scanners need to possess compatible data processing speeds as well. The increased speed results in undesirable electromagnetic interference (EMI) which is generated as a concomitant of the increased speed.

[0007] Referring to Figure 1, a commonly known prior art scanning device 10 is shown. The scanning device 10 includes

an image capturing board 102 and a mainboard 104. By way of example, the image capturing board 102 may be a charge coupled device (CCD) board. A cable couples the image capturing board 102 to mainboard 104.

[0008] The above mentioned image capturing board 102 includes an image capturing device 106 which may be CCD. The above mentioned mainboard 104 includes an analog front-end 108 (AFE), analog to digital converter 110, and clock generator 112.

[0009] The operation of device 10 is described as follows. Initially, a clock generator 112 of the image capture device 104 generates a clock signal, which is applied to the image capture component 106. This way, the image capture component 106 is driven. Consequently, the image capture component 106 transforms an optic data signal that was captured into an analog electronic signal. At this juncture, the analog front-end 108 transforms the analog electronic signal into an analog front-end electronic signal. The analog front-end electronic signal is subject to an A/D converter 110, wherein the analog front-end electronic signal is converted into a digital signal, and the digital signal is output. But it should be noted that clock generator 112 includes high frequency signals such as

shift clock signals (Φ_1, Φ_2), which are a pair of opposite phase signals. Opposite phase will be defined infra. It is known that opposite phase signals' electromagnetic interference cancel each other. However, in scanner technology, no known electronic signal transmission uses single end mode transmission.

[0010] Referring to Figure 2, the wave shape of a commonly known electronic signal V_1 under single end mode transmission is shown. As can be appreciated, analog signal V_1 has a potential level V_{os} . Typically the electro-magnetic interference is in direct proportion to signal potential level, frequency, and transmission distance. Because signal V_1 possesses high potential V_{os} as well as relatively high frequency and long transmission lines, the single end mode transmission can increase the electro-magnetic interference. Therefore, electro-magnetic interference can cause problems that are undesirable. Because the electro-magnetic interference can cause health problems, various jurisdictions have established standards with regard to the same. Therefore, how to reduce a scanning device's electro-magnetic interference so as to comport with the standards is important.

[0011] Therefore it is important to provide a scanning method

and device wherein actual magnetic interference is reduced.

SUMMARY OF INVENTION

[0012] A scanning method and device are provided with the device having signals transmitting between its components. The signals cancel each other thereby reducing electromagnetic interference.

[0013] Accordingly, a scanning device having a differential analog transmission pair is provided. The device includes: an image capture component board and a main board. The image capture component board includes an image capture component for receiving data in the form of optic signals, and transforming the optic signals into analog electric signals, and a differential output driver coupled to the image capture component for transforming the analog electric signals into differential mode and outputting a differential analog electric signal. The main board is coupled to the image capture component board, and includes a differential input receiver for receiving the differential analog electric signal, and restoring the differential analog electric signal back to the analog electric signal.

[0014] Accordingly, a method for using a differential pair in a scanner is provided. The method includes the steps of re-

ceiving optic signals representing scanned data and transforming the same into analog electric signals, transforming the analog electric signals into differential analog electric signals, and receiving the differential analog electric signals and restoring the same back into analog electric signals.

BRIEF DESCRIPTION OF DRAWINGS

- [0015] Fig. 1 shows a block diagram depicting a commonly known prior art scanning device.
- [0016] Fig. 2 shows a waveform of a commonly known prior art single mold analog signal transmission.
- [0017] Fig. 3 shows a scanning device of the instant invention.
- [0018] Fig. 4 shows a pair of waveforms of the instant invention.

DETAILED DESCRIPTION

- [0019] Referring to Figure 3, a scanning device 30 includes an image capture component board 302 and main board 304. The image capture board 302 may be a CCD board. The image capture component board 302 and main board 304 are connected by cable. The image capture component board 302 includes an image capture component 306 and a differential output driver 308. The image capture component 306 may be such components as CCD,

contact image sensor (CIS), or complementary metal oxide semiconductor (CMOS). The main board 304 includes a receiver 310, analog front 312, analog to digital converter 314, and clock signal generator 316.

[0020] The following describes the operations of the scanner 30. The above described image capture component 306 receives the optic signal of the scanned files. Component 306 further transforms the optic signal into an analog electronic signal. The above described differential output driver 308 transforms the analog electronic signal into differential analog electronic signals. For the waveform of the differential analog electronic signal, see Figure 4.

[0021] Referring now to Figure 4, a waveform according to the instant invention is shown. As can be seen, the differential analog electronic signal includes a signal identical to the analog electronic signal V_1 of Figure 2. The signal is identical in the sense that the signal possesses identical electrical potential and identical phase relationships.

[0022] The waveform possesses a second signal V_{02} having an electric potential of $-V_{01}$. The second signal V_{02} possesses identical in block reverse phase in relation to V_{01} . Because the instant combined potential of both signals is zero, the electro-magnetic interference is cancelled, facil-

itating transmission between the components such as differential output driver 308 and the receiver 310.

[0023] Furthermore, the analog signal V_{01} may be of the same phase as that of V_i of Fig. 1, but the electric potential of V_{01} is the potential of V_i plus a bias potential. V_{02} has the same phase but opposite polarity as that of V_{01} . Alternatively, signal V_{01} may have the same phase relationship as that of the signal V_i , but the electric potential of signal V_{01} is the difference of the potential of V_i and the bias potential. In other words, the potential of V_{01} equals to the potential of V_i minus the bias potential, and V_{02} is the reverse of V_{01} .

[0024] The differential input receiver 310 receives the differential analog electronic signals and transforms them back into an analog electronic signal. The analog front 312 is used to transform the analog electronic signal into an analog front signal. The analog to digital converter 314 is used to convert analog signals into digital signals. The clock generator 316 is used to provide the clock signals to the image capture component 306, to thereby drive the same.

[0025] Turning now to the operation of the scanning device 30, the first clock signal generator 316 provides the clock signals to the image capture component 306, thereby

driving the same. Next, the image capture component 306 as disclosed receives scanned data in the form of optic signals and converts the same to analog electronic signals. The differential output driver 308 transforms the analog electronic signals into a differential mode and transmits at least one pair of differential signals. Furthermore, the differential input receiver 310 receives the at least one pair of differential signals and converts the differential signals into an analog signal. Following this, the analog front 312 transforms the analog signal into an analog front signal and uses the analog to digital converter 314 to transform the analog front signal into a digital signal. The digital signal is then output.

[0026] As can be appreciated, the instant invention changes the transmission mode of signals from the original analog electronic signal into a differential pair mode, thereby using the pairing to cancel electromagnetic interference. Specifically, the instant invention changes the transmission mode of signals going from the image capture component board 302 to the main board 304. In other words, based on the notion of using a differential pair generated by a scanning device, for example by clock generator 316, canceling each other out, electromagnetic noise is can-

celled as well.

[0027] Accordingly, it is to be understood that the embodiments of the invention herein described are merely illustrative of the application of the principles of the invention. Reference herein to details of the illustrated embodiments is not intended to limit the scope of the claims, which themselves recite those features regarded as essential to the invention.